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(54) Title: BORATE CRYSTALS FOR OPTICAL FREQUENCY CONVERSION

(57) Abstract: Novel nonlinear optical materials are described having the general formula  $5 M_x M'_y \text{Sc}_z (\text{BO}_3)_4$  where M and M' are metals, typically rare earth metals, and the sum of x, y, and z is about four. One example of such a material is  $\text{La}_{0.7} \text{Y}_{0.3} \text{Sc}_3 (\text{BO}_3)_4$ . Exemplary crystalline materials according to the general formula exhibit useful optical characteristics and desirable physical properties for nonlinear optical applications. Novel compositions and devices using the nonlinear optical materials also are described.

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# INTERNATIONAL SEARCH REPORT

International application No.

PCT/US03/22075

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : G02B 5/20; C01F 3/00; G02F 1/35

US CL : 252/584; 423/263, 277; 359/328

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 252/584; 423/263, 277; 359/328

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)  
Please See Continuation Sheet

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X — Y	GRUBER et al, "Spectroscopic properties of nonlinear NdSc <sub>3</sub> (BO <sub>3</sub> ) <sub>4</sub> ", Journal of Applied Physics, Volume 87, Number 10, 15 May 2000, pages 7159-7163, see entire document.	1-2, 4-5, 11, 33-34, 41, 49, and 56 ----- 19-24 and 31
X — Y	PETERSON et al, Stoichiometric, trigonal huntite borate CeSc <sub>3</sub> (BO <sub>3</sub> ) <sub>4</sub> , International Journal of Inorganic Materials, Volume 2, Number 1, February 2000, pages 101-106, see entire document.	1-2, 4-5, 11, 33-34, 41, 49, and 56 ----- 19-24 and 31
X — Y	CN 1298217 A (FUJIAN INST. OF MATTER STRUCTURE, ACADEMIA SINICA, PEOPLE REP. OF CHINA) 06 June 2001, abstract.	1-2, 11, 33, 41, 49 and 56 ----- 3-10, 12-32, 34-40, 42- 48, 50-55, 57-59

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents:	
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"O" document referring to an oral disclosure, use, exhibition or other means	"&" document member of the same patent family
"P" document published prior to the international filing date but later than the priority date claimed	

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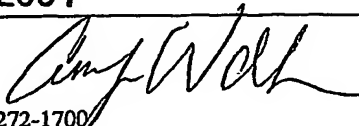
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# INTERNATIONAL SEARCH REPORT

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Continuation of B. FIELDS SEARCHED Item 3:  
CAS ONLINE, REG, CA  
search terms: scandium, borate, nonlinear, non-linear, optical